

WHAT IS CLAIMED IS:

- 1 *sub a1* 1. A filler neck for receiving a fuel supply nozzle for a motor
2 vehicle fuel tank comprising:
3 a one-piece stainless steel seamless funnel member having a
4 tubular body defining in off-set axial relation to each other a relatively large inlet
5 opening adapted for attachment to a receptor for positioning the nozzle with respect
6 to the large inlet opening and a relatively small necked down outlet opening adapted
7 for attachment to the inlet of an elongated tubular member in communication with
8 the fuel tank, the positioning of the nozzle in combination with the off-set axial
9 relation inducing a sufficient swirl to the fuel being supplied so as to create a
10 sufficient vacuum to prevent fuel vapors from escaping into the atmosphere.
- 1 2. The filler neck of claim 1 wherein the inlet opening is rolled
2 over to create a surface to seal to the gas cap.
- 1 3. The filler neck of claim 1 wherein the small necked down
2 outlet opening is barbed to adapt the opening for attachment to a plastic tube insert.
- 1 4. The filler neck of claim 1 wherein the small necked down
2 outlet opening is formed into a hose bead to adapt the opening for attachment to a
3 hose.
- 1 5. The filler neck of claim 1 further comprising a vent hole
2 adapted for connection to a fuel tank vent tube.
- 1 6. The filler neck of claim 1 including the receptor and wherein
2 the funnel member is drawn and provided with an attachment portion adjacent to the
3 inlet opening for attaching the receptor to the funnel member.
- 1 7. The filler neck of claim 1 including the inlet of the elongated
2 member and wherein the funnel member is joined to the elongated member inlet by
3 a braise.

1 8. The filler neck of claim 1 including a tubular member and
2 wherein the funnel member is joined to the tubular member inlet by adhesive.

1 9. The filler neck of claim 1 including a tubular member and
2 wherein the funnel member is joined to the tubular member inlet by a resistance
3 weld.

1 10. The filler neck of claim 1 including a tubular member and
2 wherein the funnel member is joined to the tubular member inlet by a weld.

1 11. The filler neck of claim 1 including an exterior surface on the
2 filler neck and wherein substantially all of the exterior surface of the filler neck is
3 provided with an anti-corrosive coating.

1 12. The filler neck of claim 1 wherein the funnel member further
2 comprises:

3 a relatively large diameter section forming the inlet opening
4 and a spaced-apart relatively smaller diameter tubular section forming the outlet
5 opening wherein the axially offset large diameter and small diameter tubular sections
6 are connected to one another by a tapered section which gradually blends from the
7 large diameter section to the small diameter section.

1 13. The filler neck of claim 12 wherein the tapered section
2 intersects the large diameter section at an elliptically-shaped junction which lies in
3 a plane inclined 60-85° from the axes of the tubular sections.

1 14. The filler neck of claim 12 wherein the funnel inlet opening
2 has a diameter D_1 and the tubular section has a diameter D_2 with a coaxial offset at
3 a distance X where $.1D_2$ is less than X which is less than $.3D_2$, and where D_{T1} is at
4 least one and a half times D_2 .

1 15. The filler neck of claim 14 wherein the funnel inlet axial offset
2 is sufficient to achieve fuel swirl during fuel filling.

1 16. The filler neck of claim 1 wherein the funnel inlet opening has
2 a diameter D-1 and the outlet opening has a diameter D-2 where D-1 is at least one
3 and a half times D-2.

1 17. The filler neck of claim 16 wherein D_2 is less than 35 mm.

1 18. The filler neck of claim 16 wherein the D_2 is less than 30 mm.

1 19. The filler neck of claim 1 wherein the one-piece seamless
2 funnel member if made of metal.

1 20. The filler neck of claim 19 wherein the metal is selected from
2 the group consisting of cold rolled steel, stainless steel, zinc galvanized, terne plate,
3 tin plate, nickel plate, galvaneal, and aluminum.

1 21. The filler neck of claim 1 wherein the one-piece seamless
2 funnel member if made of plastic.

1 22. The filler neck of claim 19 wherein the one-piece seamless
2 funnel member if made by eyelet stamping.

1 23. The filler neck of claim 19 wherein the one-piece seamless
2 funnel member if made by progressive die stamping.

1 24. The filler neck of claim 19 wherein the one-piece seamless
2 funnel member if made by transfer die stamping.

1 25. The filler neck of claim 19 wherein the one-piece seamless
2 funnel member if made by hydroforming.

1 26. The filler neck of claim 21 wherein the one-piece seamless
2 funnel member if made by injection molding.

1 ²⁸
~~27.~~ A method of forming a filler neck for a motor vehicle fuel tank
2 comprising:

3 deep-drawing a seamless funnel member having an elongated
4 tubular body with a relatively large inlet at one end and a relatively small outlet at
5 the opposite end.

6 cutting a length of butt-seam tubing to form a tubular member
7 of desired length;

8 telescopically joining an end of the tubular member with
9 respect to the outlet of the funnel member to securely join the funnel and tubular
10 members together;

11 bending the tubular member to the desired shape; and

12 attaching a nozzle receptor to the funnel member adjacent the
13 funnel member inlet.

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~~28.~~ The method of claim ~~27~~ further comprising leak testing the
2 filler neck to verify the integrity of joining the funnel member to the tubular member
3 and the integrity of attaching the nozzle receptor to the funnel member, and the
4 integrity of the butt-seam tubing of the tubular member subsequent to bending the
5 tubular member to the desired shape.

1 ³⁰ ²⁸
~~29.~~ The method of claim ~~27~~ wherein the funnel member is joined
2 to the tubular member by braising.

1 ³¹ ²⁸
~~30.~~ The method of claim ~~27~~ wherein the funnel member is joined
2 to the tubular member by adhesive bonding.

1 ³² ²⁸
~~31.~~ The method of claim ~~27~~ wherein the funnel member is joined
2 to the tubular member by welding.

- 1 32. A filler neck for receiving a fuel supply nozzle for a motor
2 vehicle fuel tank comprising:
3 a one-piece stainless steel seamless funnel member having a
4 tubular body defining a relatively large inlet opening adapted for attachment to a
5 receptor for positioning the nozzle with respect to the large inlet opening and a
6 relatively small necked down outlet opening adapted for attachment to the inlet of an
7 elongated tubular member in communication with the fuel tank.

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